national accelerator laboratory

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Subject

DIMENSIONAL STUDY OF INTERSECTING STORAGE RINGS

The effect of variations of basic dimensional parameters on the size and energy of storage rings is studied:

1. Two patterns are used, one with 6 equal-length inserts and one with 4. With 6 inserts, 2 are for injection, 2 are completed as experimental halls, and 2 are spares for future experimental halls. With 4 inserts, 2 are for injection and 2 for experimental halls.
2. Three circumferential sizes are used, representing 1/3, 1/4, and 1/6 of the main ring orbit.

For uniformity in analysis and comparison, certain features are common:

1. The normal bending cell is the FOBODOBO type, of length 22.0 meters, as proposed by Teng, with an integral number of normal cells in each 60° or 90° sector.
2. The length of each insert is approximately 85 meters, and includes the ±25 meter free space around the intersection region at the center.
3. Magnetic field in bending magnets is taken as 20, 40, and 60 kG, representing typical fields for iron-cored, cryogenic and super-conducting magnets (assuming success in future developments).

Results are shown in the Table. A sketch (to scale) of the three sizes of rings with 6 inserts are shown in Fig. 1, with a possible arrangement for filling the rings from the main ring. Fig. 2 shows the same dimensional features for the 4-insert rings.

The significant differences for analysis are summarized in the circumference factors, which are roughly proportional to the ratio of cost of structures to cost of components, and in the beam energies resulting from the different arrangements.

Dimensional Study of Intersecting Storage Rings: Table of Relative Dimensions:

	6 inserts:			4 inserts:			
R_{av}, radius of ring	333.3	250.0	166.7	333.2	250.0	166.7	meters
C_{tot}, total ring circum.	2094.4	1570.8	1047.2	2094.4	1570.8	1047.2	meters
N_n, number of normal cells	72	48	24	80	56	32	
N_{sec}, number normal cells/sector	12	8	4	20	14	8	
L_n, length of normal cell	22.0	22.0	22.0	22.0	22.0	22.0	meters
$C_s = N_n L_n$, length of all cells	1584.	1056.0	528.0	1760.0	1232.0	704.0	meters
$L_{tot} = C_{tot} - C_s$, length all inserts	510.4	514.8	519.2	334.4	338.8	343.2	meters
L_i, =length of each insert	85.1	85.6	86.4	83.5	84.8	85.8	meters
R_s, radius of sectors	252.2	168.0	84.2	280.0	196.5	112.0	meters
ρ, bending radius in magnets	168.3	112.0	56.1	186.6	131.0	74.7	meters
$C_b = 2\pi\rho$, total bending circum.	1057.7	704.5	352.6	1173.0	822.0	469.0	meters
C_{tot}/C_b, circumference factor	1.98	2.23	2.97	1.78	1.91	2.23	
B, field of bending magnets	20. 40.	40. 60.	40. 60.	20. 40.	40. 60.	40. 60.	kilogauss
E, energy of proton beam	100. 200.	133. 200.	67. 100.	111. 222.	156. 234.	89. 133.	GeV

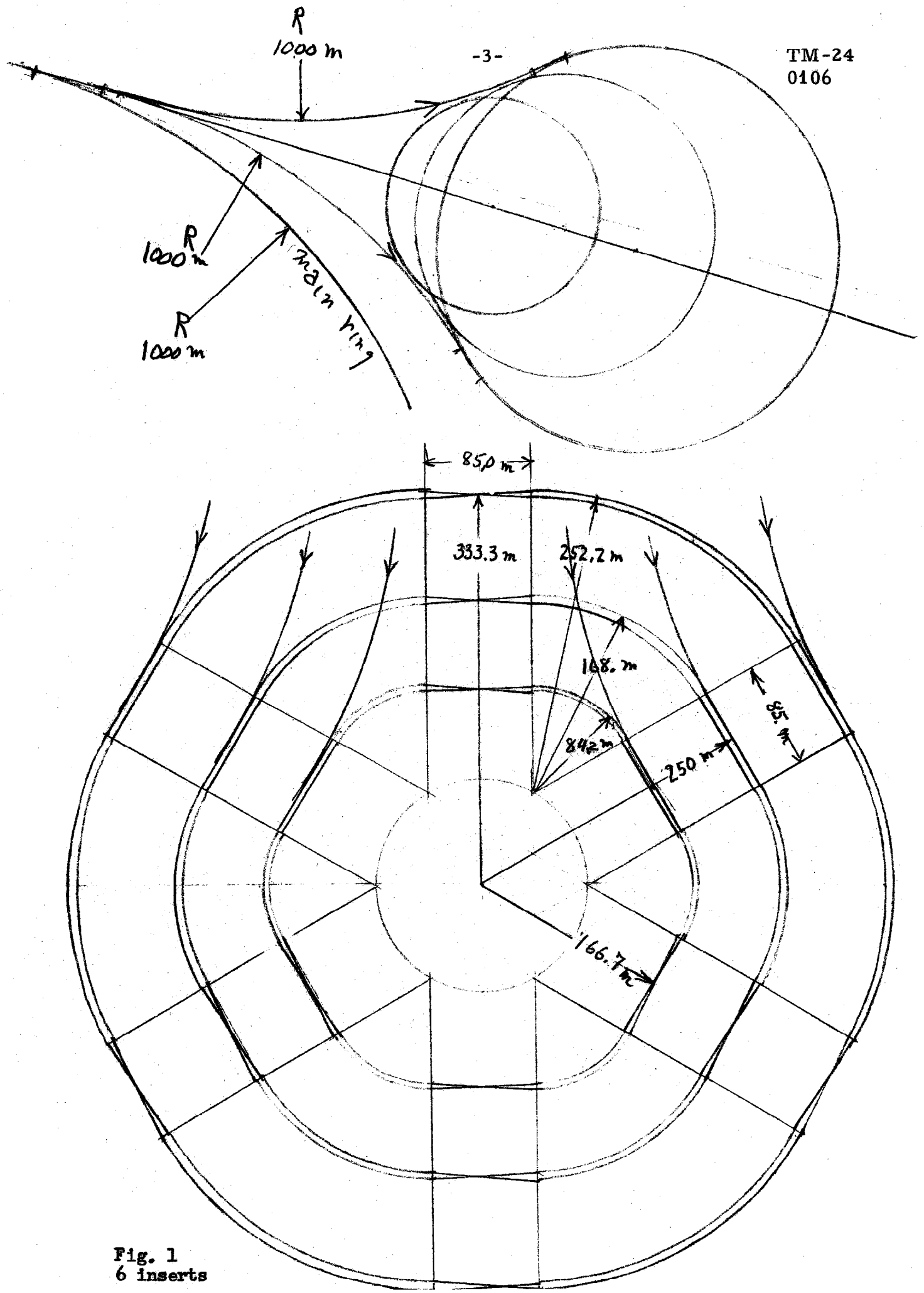

Fig. 1
6 inserts

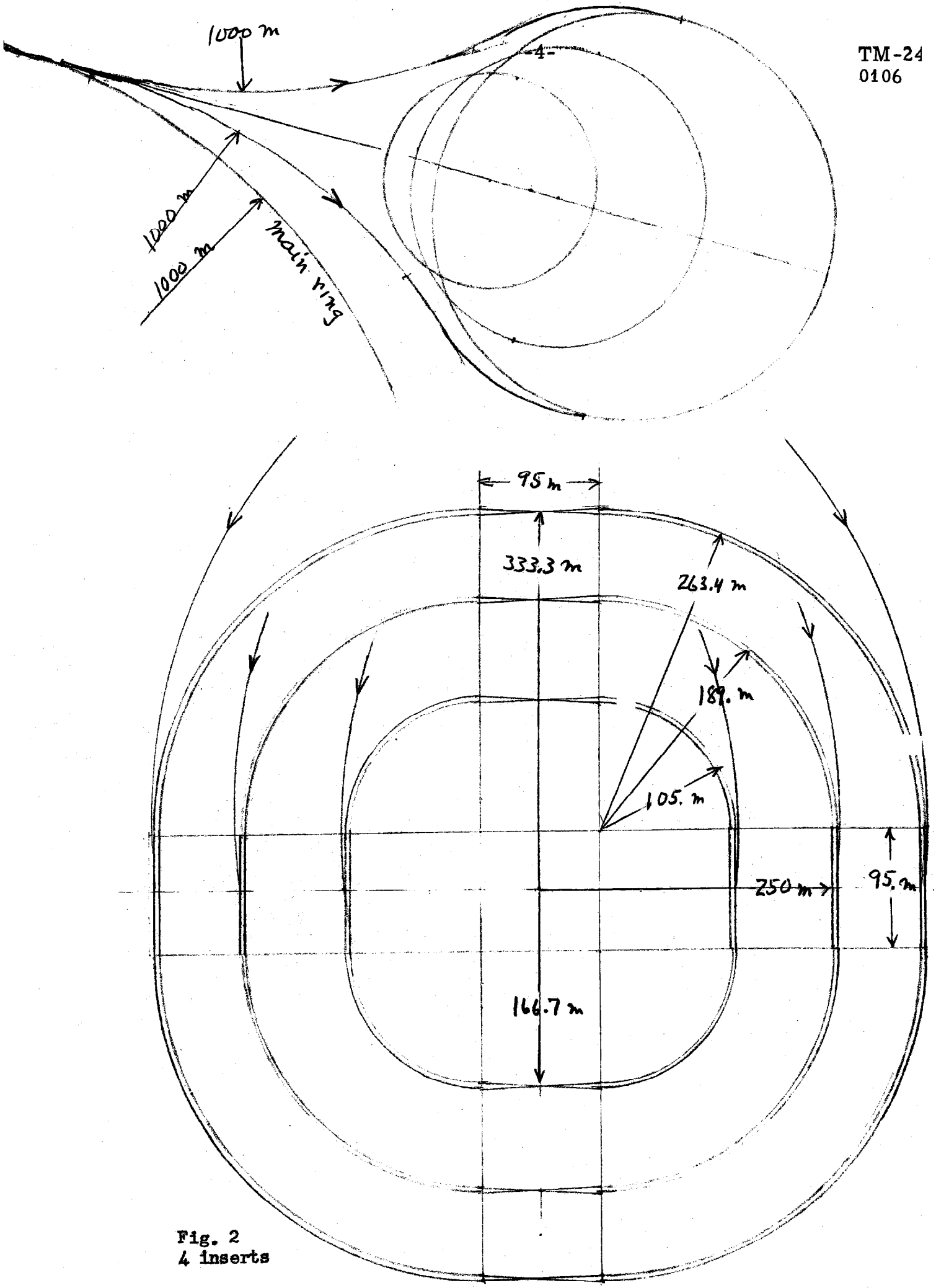

Fig. 2
4 inserts